

Appl. No. 10/577,652  
Amendment dated January 18, 2012  
Reply to Office Action of September 26, 2011

### **REMARKS/ARGUMENTS**

The applicants have carefully studied the outstanding Final Office Action. The proposed claims have been amended to more distinctly and clearly recite the features of the present invention claimed over the prior art cited. The present amendment is intended to be fully responsive to all points of rejection raised by the Examiner, and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application are respectfully requested.

Claims 1, 3-7, 9, 10, 15, 16, 19-21 and 23-31 are pending in the application, have been examined, and now stand rejected by the Examiner. By way of the present amendment, claims 1, 5, 15 and 16 have been amended. Claims 9, 10, 23-25 and 28-31 were canceled. Claims 32-35 have been added.

### **Response to Examiners response to Applicants argument**

Applicant would like to clarify an aspect of the terminology used in this application, which the Examiner may not have fully appreciated. The applicant has carefully distinguished between the use of the term convergence vs. reassembly. Applicant would like to clarify the terminology used in the specifications and the claims regarding beam convergence. A "converging beam" is generally understood to be a beam along which cross section area reduces until a focal point at which the cross section area is minimal. Further along, the beam diverges. Fluence is the amount of energy applied per unit area, so the fluence of a converging beam increases and reaches its maximum at the focal point.

It is to be understood that the beam conversion system of the present invention operates to recombine the spread out beam components onto the target volume. The beam converter can operate on a pure collimated beam, which can maintain a non-convergent collimated nature as it is spread out, and as the spread out radiation is reassembled. The terms reconverge, reassemble, recombine, recollect or similar, as used and claimed in the application, are not mean to imply optical convergence of a beam, such as is accomplished by an element having optical power, but rather the collection of the spread-out beam components, whether spatially or temporally, such that they meet and cross at the target volume. The input, spread out and reassembled or reconcentrated beam components can be optically converged, diverged or collimated, but the beam converter of the present invention operates in a manner unrelated to these properties. For example, the beam 42 of Fig. 4A which recombines at target volume 46, is diverging, while the beam 48 of Fig. 4B which also recombines at target volume 46, is converging.

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### **Specification**

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. Correction of the following is required: The flat mirror of claim 31.

Claim 31 was canceled.

### **Claim Rejections - 35 USC §112**

Claims 1 and 15 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. The rigid connection between the second radiation directing element and the rotator is critical or essential to the practice of the invention, but is not included in the claims and is not otherwise enabled by the disclosure. In instances in which there is a single reflective element, the rigid connection with the rotator and or beam divider is critical.

Applicant submits that the rigid connection between the second radiation directing element and the rotator is not critical for all embodiments. For example, in the embodiment shown in FIG. 3D, there is a single reflective element (25D), but the rigid connection with the rotator is not required.

Accordingly Applicant submits that the claims do comply with § 112 first paragraph and therefore requests withdrawal of this objection.

Claim 16 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as his invention.

Regarding claim 16, applicant recites a single reflective element when it is likely that the second radiation directing element is intended, so as to be consistent with the limitation of claim 3. For purpose of prior art examination, Examiner had assumed this was the intended limitation. The scope of the claim is unclear, because it is unclear what the single reflective element refers to.

Claim 16 was amended to recite "second reflective element".

Accordingly Applicant submits that the amended claim does now comply with § 112 second paragraph and therefore requests withdrawal of this objection.

### **Claim Rejections - 35 USC §103**

Prior claims 9, 10, 23-25, 28 and 30 were rejected under 35 USC §103(a) as unpatentable over Azar et al. (7066929), hereinafter Azar in view of Chan (5378582).

Applicants have cancelled these rejected claims without prejudice and reserve the right to file divisional or continuation applications directed to the rejected subject matter.

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Claims 1, 3-7, 15, 16, 19-21-26, 27 and 29-31 are rejected under 35 USC §103(a) as allegedly being unpatentable over Azar in view of Libby (4413180).

Regarding claims 1,4,15 and 29, Azar teaches performing selective photothermolysis on subcutaneous tissue using plurality of beams that have energy insufficient to cause damage at the surface, but overlap within the tissue to cause damage (abstract). Thus, radiation at the surface is less than the maximum fluence of radiation within the tissue. Azar teaches using radiation between 550-800 nm (Col 6), which is within Applicant's claimed range.

Examiner further states that Azar clearly demonstrates Applicant's central concept of using a plurality of beams to affect a volume of tissue beneath the skin surface, but does NOT use the apparatus recited in the claims.

Examiner further directs attention to Libby who teaches a light source (70; Figures 11 and 12) that emit light to a beam spreading assembly (90) comprising a fixed cylindrical reflector (94), or second radiation directing element, having a light reflecting surface and mirror (98) or first radiation directing element mounted to rotatable hollow shaft or rotator (102; Col.5). The mirror is secured to the shaft via a mounting bracket (106). Both reflectors have curvatures in one plane. The radiation does not impinge a region along the central axis of the shaft (Figure 9).

Libby also teaches modifying the angle that the redirected beam takes from the second radiation directing reflector with respect to other embodiments (Col. 5-17; Figure 9).

Examiner further states that although Libby does not appear to provide the means to control that angle in the embodiments discussed with respect to figures 11 and 12, it would have been obvious to skilled artisan at the time the invention was made to provide means by which to change the angle of the reflecting surface (98) to increase/decrease the exit angle.

Examiner states that it would have been obvious to carry out the method of Azar with the apparatus of Libby because doing so would enable the method of Azar to be performed with a single light source, rather than multiple sources. Furthermore, Libby's apparatus is less susceptible to inaccuracies because only one mirror is angled with respect to fixed optics, while even the simplest embodiment of Azar's device requires angling two sources, and because a single source will have a predictable optical output.

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Applicant submits that Libby's apparatus is a device for image acquisition which utilized a non-planar beam of electro-magnetic radiation to illuminate an object by scanning the beam **focused on the surface** of the object. During the excitation time of the laser, the beam impinges from the surface towards a X,Y sensor that captures the information necessary for terrain geometries of an object. Applicant submits that without significant modifications, not taught in the prior art, Libby's apparatus would be useless for delivering the beam beneath the surface.

Applicant submits that the proposed combination would not be physically possible or operative because each reference teaches away from each other. Azar teaches using plurality of non focused beams and overlapping them beneath the skin surface for treating a volume below the surface while sparing the surface, while Libby teaches using a focused beam for producing the illumination intercept (18) on the surface (Fig. 12).

Applicant also asserts that the proposed combination would not be obvious because Azar's teaching belongs to the class of Surgery while Libby's teaching belongs to the class of Radio and Microwave Absorption Wavemeters. It's unobvious for skilled artisan at the time the invention was made to combine inventions from different and unrelated classes.

Applicant has amended claims 1 to recite "...wherein said rotator is adapted to direct said beam in directions such that any given point of said target volume is exposed to said radiation during the entire energy excitation period of said beam, while any given point of said rotational path on said surface is exposed to said radiation only during portion of said energy excitation period, and..."

Support for this amendment is to be found in paragraph 0025 of the specification as published.

Applicant has amended claims 15 to recite "...wherein any given point of said target volume is exposed to said radiation during the entire energy excitation period of said beam, while any given point of said rotational path on said surface is exposed to said radiation only during portion of said energy excitation period, and..."

Support for this amendment is to be found in paragraph 0025 of the specification as published.

Applicant submits that amended independent Claims 1 and 15 are novel over Azar and Libby, or any combination thereof since as stated, in none of those references:

1. A single beam that rotates (Azar uses multiple beams and doesn't rotate)
2. Deliver radiation to a target **beneath skin surface** (Libby targets the surface only)

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3. The target is exposed during the **entire** energy excitation period, while any given point of the rotational path on the surface is exposed to radiation only during **portion** of energy excitation period. (In Azar's teaching, both the surface and the target are exposed during the entire excitation period. In Libby, the surface is the target and it is exposed during the entire excitation period).

Examiner states that regarding claims 3 and 16, Libby teaches that the second radiation directing element can be rigidly mounted to the rotator via spiders (108; Figure 12).

Applicant submits that dependent claims 3 and 16 are dependent variously on independent claims 1 and 15 as amended, which the applicant deems patentable. Therefore claims 3 and 6 are also deemed patentable.

Examiner states that regarding claim 6, Azar's method requires that the focal point of the redirected beams of Libby be beyond the target volume. After modification of Libby to enable the beams to converge, this limitation is inherent in the modified Libby apparatus.

Applicant submits that such modification of Libby wasn't taught or even suggested in his teaching. On the contrary, by so doing would render the apparatus of Libby as being useless for its intended use of producing the illumination intercept (18) on the surface.

Examiner states that regarding claims 5 and 30, Libby uses a flat mirror (98), to reflect the light from the source. Therefore, the beam is necessarily split into smaller beams that contain less intensity than the input intensity.

Applicant submits that Libby redirects the beam, but does not split the beam into smaller beams. Libby clearly shows (Figs. 9 and 12, Col 5, line 8) that the redirected beam focuses on the surface. Therefore, the **FLUENCE** of Libby's redirected beam is **higher** than the **FLUENCE** of the input beam. Applicant submits that the definition of fluence is the amount of energy applied per unit area, so the fluence of a focused beam (that by definition has smaller area) is inherently higher than the fluence of the input beam.

Claim 5 was amended to recite "redirected beam is less than or equal to said energy fluence of **said input beam**".

Examiner states that regarding claims 7 and 21, Azar teaches that the light incident on the skin is collimated by collimating optic (82; Figure 6). Although Koziol does NOT provide such an optic for the redirected light, it would have been obvious to provide one because doing so would reduce the interference of light beams/pulses with other beams/pulses redirected from the same reflector. This reduction in interference would result in more predictable and reproducible results.

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Applicant assumes the Examiner is referring to Libby and not to Koziol. Applicant repeatedly submits that it is NOT the light incident on the skin that is collimated. The collimating optics in Azar's teaching is part of the sensing unit for sensing the temperature of the skin - "the sensing unit may include an optical sensor 81 and a collimating optical element 82 (page 10, lines 23-25). Providing collimated optics with Libby's device is the **opposite** from Libby's teaching that applies **focused** beams (Col 5 line 8).

Examiner states that regarding claim 31, Libby does not teach that the second radiation directing element is flat. However, it would have been obvious to make it flat because Libby clearly discloses that the purpose of the cylindrical reflector is direct the beam to the target surface, not enhance the beams' power. Therefore, it would have been obvious to replace the cylindrical reflector of Libby with a flat mirror, because doing so would not change the principles of the device and flat mirrors are more readily available and cheaper.

Claim 31 was canceled.

New dependent claim 32 recites an "apparatus according to claim 1 wherein said period of said rotation is shorter than or equal to said energy excitation period". Support for this amendment is to be found in paragraph 0097 of the specification as published.

New dependent claim 33 recites an "apparatus according to claim 1 wherein said energy excitation period is a multiple of said period of said rotation". Support for this amendment is to be found in paragraph 0157 of the specification as published.

New dependent claim 34 recites an "apparatus according to claim 1 wherein said energy excitation period is from 1 millisecond to 300 milliseconds". Support for this amendment is to be found in paragraphs 0180, 0190, 0194 and 196 of the specification as published.

New dependent claim 35 recites an "a method according to claim 15, and further comprising the step of providing a first radiation directing element and a second radiation directing element wherein said energy fluence of said redirected beam is less than or equal to said energy fluence of said input beam.

Accordingly Applicant submits that the amended claims do comply with 35 USC §103(a) and therefore requests withdrawal of this objection.

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**Conclusion**

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

Respectfully submitted

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Applicant

